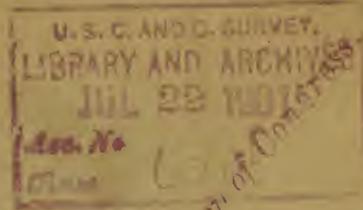


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The Engineer

TO RULE THE

Twentieth Century

BY

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OF
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Engineer to Rule the Twentieth Century.

The twentieth century will be pre-eminently the age of the engineer—the man of applied science. It will be permeated by the scientific spirit. Historically speaking, this scientific spirit has long been in the minds of men, but only within the small reach of the latter part of the nineteenth century has it filtered through to the masses, influenced their daily life, and become an important factor in the industrial world. To realize what inventiveness and ingenuity—the precursors of the scientific spirit—have done, note that in 1819 the cost of ruling 100 reams of paper by hand was \$400; the same work can be done now by machinery at a cost of 85 cents. The watch that in 1862 cost \$65.41 made by hand can now be made by machinery for \$1.10. To print 100 rolls of wall paper by hand would cost \$42.00, but with the aid of machinery it would cost only 13 cents.

The next twenty-five years will show still more marvelous improvements, for the work of the engineer has just begun. Wherever new lands are to be opened, bridges built, railroads constructed, water or sewerage systems installed, there the civil engineer will be needed. Wherever in the broad field of industrial activity new machinery is to be devised, more economical power plants constructed, cheapened processes of manufacture invented, or new applications of electricity suggested, there the mechanical engineer, the chemical engineer, or the electrical engineer will find his special field of activity.

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It is pertinent to ask, then, what kind of a man will the twentieth century engineer be? In the first place he will be a cultured man. "By culture I mean," said Charles Dudley Warner, "that fine product of opportunity and scholarship which is to mere knowledge what manners are to the gentleman." In the future this culture will not come from a study of the classics, but from a familiarity with the best literature in the modern languages. While the education of the engineer must come largely from the shop and the laboratory, yet no error can be greater than to suppose that he can divorce himself from books. Herein are the records of those experimenters who, perchance, have tried and failed; likewise the stories of successes; from both the engineer may learn much. Engin-

ering literature in books, in the technical press, in the publications of technical colleges, and in the proceedings of engineering societies is growing apace. As neither the lawyer, the doctor, nor the minister can succeed without a well-selected library, so the engineer cannot hope to succeed without the aid of the published records of the work which other members of his profession have accomplished.

The man who would pretend to succeed without the aid of books is the so-called practical man, the rule of thumb man. But he is rapidly passing away and his place is being taken by the technically trained man—the one who has learned from the shop, the laboratory, the book, the fundamental principles of science and their applications. The industrial ruler of the twentieth century will be the engineering specialist, who will add to sound general scholarship and broad scientific training highly specialized knowledge in some chosen field of work. He will be a practical idealist. He will be so trained that he can correctly use his constructive imagination, can reason accurately and clearly, and through printed records can make use of the work of his predecessors.

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In the realm of mathematics his training will be most rigid and exact. He will cut loose from the idealistic, academic mathematics, as the student of higher literature will cut loose from mere grammars. His mathematics must run down through his fingers, as it were. Mere juggling with symbols will be useless to him. He must regard his mathematics as one of his tools, as a means to an end, or as a language in which to express his thoughts. The future engineer may be successful if his training has included a greater or less amount of shop practice with perhaps indifferent laboratory instruction and a meager equipment, but no engineer can be broadly successful and thoroughly competent without a deep and exhaustive theoretical treatment of engineering subjects. This does away with the common opinion that literature and books are not essential to the engineer's success, for the next quarter of a century will see the engineering profession rise to the dignity of the older professions. It behooves the young engineer, then, to recognize this tendency and to do his part towards raising the standard of his chosen profession.

The relations which the engineer will bear to the great political and industrial changes are many and important. The coming era of industrial regeneration will be the result of a more accurate knowledge of science and a closer application of its principles; the engineer will be the missionary. The mechanic, the trained artisan, and the technical man, not the

farmer, will be the pioneer. The warfare of the future will be industrial and political, rather than military. Already we see the signs. The barbarous idea of depleting conquered lands or dependent colonies for the benefit of the conquering nation is yielding to the more civilized idea of internal improvements, with material advantage to both parties. Because Spain plundered her colonies and refused to advance with the age of science, she is no longer a factor in Western civilization. The world will become an industrial battlefield. The diplomat will become more and more a high-grade commercial agent; the military leader will be a preserver of law and order, rather than a destroyer of life and property; and the engineer will be their chief executive in adapting the forces of nature to the convenience of man. The great change in economic and industrial life of the twentieth century will be the work of the engineer.

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The conditions which will beset the engineer of the twentieth century will be exacting beyond anything we now know. The importance of a strong foundation in scientific principles cannot be overestimated, for scientific principles are only the laws of nature. These principles cannot be learned readily after a man has begun his life work. His whole energy will then be devoted to applying these principles correctly, not in acquiring them laboriously. It will be a prime necessity for the technical college of the future to lay these foundations broad and deep. It will be regarded as a weakness for a college to teach its students only the knacks of the profession, only just enough to be an ordinary draftsman, a tolerable surveyor, or first-class linesman.

The technical graduate of the twentieth century will be marked by certain characteristics which are too rarely found in men trained in the colleges of literature and arts. Among these are directness of purpose, intellectual accuracy, and clear thinking. The student of science and technology is trained in the realm of realities, where to commit error, to act without purpose, or to think vaguely are seen at once to be fruitful of harm. Economic and industrial needs will bring education from the cloistered lecture-room into the open air of the laboratory. Technical education will have a practical, helpful bearing upon the problems of life. No longer will the seclusion of the scholar be a mark of honor. Education will be found at the bench, by the forge, in the shop, the laboratory, and the drafting-room, as well as in the library. The lesson to be taught will be how to apply scientific ideas to the solution of problems actually arising in the struggle to bring the forces of nature under the sway of man.

The tendency at the present time—one which will become more pronounced as the years go by—is towards a broader and more varied extension of the work of the engineer. Just as nature knows no such thing as classification—this being arbitrarily arranged by the intellect of man—so nature, in yielding to the effects of man to subjugate her, draws no lines of demarcation between mechanical, electrical, civil, or chemical engineering. These are only division lines drawn to aid the young man in selecting the field in which he may make himself most proficient. But, when he enters upon his struggle, he may, and probably will, need a knowledge of each of these departments. Consequently the under-graduate work of the technical college of the future will be broad and diversified. Not until the years of post-graduate study, or during busy professional life, will the pursuit of a specialty be begun.

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As technical education develops questions of far-reaching importance must be settled. Probably the most important will be the decision as to what kind of man shall guide the technical college. In law, medical, and theological schools the lawyer, the doctor, and the minister, respectively, hold first place and have much to say both in the actual training and in the management of the schools. Prominent members of the profession direct the destinies of the schools. To a much less extent do practicing engineers influence the technical schools.

This condition is due to the fact that engineering schools are at present less professional in character than either the law, the medical, or the theological school. Most of them include cultural subjects in their curricula; they have been organized, in many places, in connection with state universities and have been subordinated to the general university plan. Frequently their development has been retarded by the conservative, if not baneful, influence of other departments. In only a few instances have the engineering colleges been granted the privilege of growing in fertile soil, adapting themselves to their own appropriate environment and producing such fruit as they were most capable of growing.

The engineering college represents that form of scientific education most suitable to the exacting demands of advancing civilization. The particular form of education which it gives through shop and laboratory practice, through practical tests, through acquaintance with the needs of industry, must not and will not be retarded by the classic heirlooms of the literary college. The engineering college must fill its own niche and work out its own salvation. Technical education is an educational and not an engineering problem.

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The technical college in which the future engineer is to be trained has several important characteristics to maintain. First, to educate scientifically and technically those who shall lead the march of the coming civilization in industrial lines; second, to educate the public to a true sense of the value of applying scientific principles to industrial processes; third, as the university has for one of its functions the extension of human knowledge in any and all lines, so the technical colleges will recognize that the investigation of questions relating to applied science is within its own sphere of usefulness. Probably no investigation to-day would be more fruitful of good results to the engineering profession and to the public at large than the systematic study and thorough test of materials of construction. Such an investigation done on a large scale, on specimens of full building size, in a scientific manner, would save millions of dollars and put the science of construction on a scientific and economic basis. While the university asks no questions about the usefulness of the information gathered within its walls, the technical college must make its investigations in fields that are distinctly useful.

The most significant tendency which an observer of educational progress sees to-day is that of specialization. The time is fast approaching when it will be recognized that merely a general education, whether on classical or scientific lines, is not alone a suitable preparation for life. Not that culture is less desirable than formerly, rather it is more desirable, but above this general substructure must be placed a technical education which will give that special application to some calling which the coming age will demand. Colleges which devote their attention solely to general cultural training will become of less importance. The institutions now known by various titles as technical colleges, institutes of technology, and polytechnic institutes, are the colleges of the twentieth century which will do most for their students, which will be in closest touch with the needs of civilization, which will provide at once the most cultural, the most rational, and the most scientific instruction. These institutions, by whatsoever name designated, will be the important colleges of the future, because they will give that perfect unity of thought and action, that harmony of theory and practice, which the educational needs of the future demand.

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